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### 1 [Delaying physical register allocation through virtual-physical registers](#)

Teresa Monreal, Antonio González, Mateo Valero, José González, Victor Viñals

 November 1999 **Proceedings of the 32nd annual ACM/IEEE international symposium on Microarchitecture**

Full text available: pdf (865.88 KB)

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Register file access time represents one of the critical delays of current microprocessors, and it is expected to become more critical as future processors increase the instruction window size and the issue width. This paper presents a novel physical register management scheme that allows for a late allocation (at the end of execution) of registers. We show that it can provide significant savings in number of registers and thus, it can significantly shorten the register file access time ...

### 2 [Register file and memory system design: Three-dimensional memory vectorization for high bandwidth media memory systems](#)

Jesus Corbal, Roger Espasa, Mateo Valero

 November 2002 **Proceedings of the 35th annual ACM/IEEE international symposium on Microarchitecture**

Full text available: pdf (1.29 MB)

 Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

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Vector processors have good performance, cost and adaptability when targeting multimedia applications. However, for a significant number of media programs, conventional memory configurations fail to deliver enough memory references per cycle to feed the SIMD functional units. This paper addresses the problem of the memory bandwidth. We propose a novel mechanism suitable for 2-dimensional vector architectures and targeted at providing high effective bandwidth for SIMD memory instructions. The basic ...

### 3 [Modulo scheduling: Modulo scheduling with integrated register spilling for clustered VLIW architectures](#)

Javier Zalamea, Josep Llosa, Eduard Ayguadé, Mateo Valero

 December 2001 **Proceedings of the 34th annual ACM/IEEE international symposium on Microarchitecture**

Full text available: pdf (1.09 MB)

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Clustering is a technique to decentralize the design of future wide issue VLIW cores and enable them to meet the technology constraints in terms of cycle time, area and power dissipation. In a clustered design, registers and functional units are grouped in clusters so that new instructions are needed to move data between them. New aggressive instruction scheduling techniques are required to minimize the negative effect of resource clustering and delays in moving data around. In this paper we pres ...

#### 4 Two-level hierarchical register file organization for VLIW processors

Javier Zalamea, Josep Llosa, Eduard Ayguadé, Mateo Valero

December 2000 **Proceedings of the 33rd annual ACM/IEEE international symposium on Microarchitecture**


Full text available:  [pdf\(154.90 KB\)](#)

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#### 5 Multiple-banked register file architectures

José-Lorenzo Cruz, Antonio González, Mateo Valero, Nigel P. Topham

May 2000 **ACM SIGARCH Computer Architecture News , Proceedings of the 27th annual international symposium on Computer architecture**, Volume 28 Issue 2

Full text available:  [pdf\(106.23 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)


The register file access time is one of the critical delays in current superscalar processors. Its impact on processor performance is likely to increase in future processor generations, as they are expected to increase the issue width (which implies more register ports) and the size of the instruction window (which implies more registers), and to use some kind of multithreading. Under this scenario, the register file access time could be a dominant delay and a pipelined implementation would ...

**Keywords:** bypass logic, dynamically-scheduled processor, register file architecture, register file cache

#### 6 A performance study of out-of-order vector architectures and short registers

Luis Villa, Roger Espasa, Mateo Valero

July 1998 **Proceedings of the 12th international conference on Supercomputing**

Full text available:  [pdf\(1.09 MB\)](#) Additional Information: [full citation](#), [references](#), [index terms](#)

#### 7 A victim cache for vector registers

Roger Espasa, Mateo Valero

July 1997 **Proceedings of the 11th international conference on Supercomputing**

Full text available:  [pdf\(1.26 MB\)](#) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

#### 8 Heuristics for register-constrained software pipelining

Josep Llosa, Mateo Valero, Eduard Ayguadé

December 1996 **Proceedings of the 29th annual ACM/IEEE international symposium on Microarchitecture**

Full text available:  [pdf\(1.44 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Software Pipelining is a loop scheduling technique that extracts parallelism from loops by overlapping the execution of several consecutive iterations. There has been a significant

effort to produce throughput-optimal schedules under resource constraints, and more recently to produce throughput-optimal schedules with minimum register requirements. Unfortunately even a throughput-optimal schedule with minimum register requirements is useless if it requires more registers than those available in t ...

### **9 A Content Aware Integer Register File Organization**

Gonzalez Gonzalez, Adrian Cristal, Daniel Ortega, Alexander Veidenbaum, Mateo Valero  
March 2004 **ACM SIGARCH Computer Architecture News , Proceedings of the 31st annual international symposium on Computer architecture - Volume 00,**  
Volume 32 Issue 2

Full text available:  pdf (6.48 MB)

Additional Information: [full citation](#), [abstract](#)

A register file is a critical component of a modern superscalar processor. It has a large number of entries and read/write ports in order to enable high levels of instruction parallelism. As a result, the register file's area, access time, and energy consumption increased dramatically, significantly affecting the overall superscalar processor's performance and energy consumption. This is especially true in 64-bit processors. This paper presents a new integer register file organization, which reduces energy co ...

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